



**Office of Naval Research
Collaboration and Knowledge Management Workshop
January 24 – 26, 2006**

**NPS TESTBED FOR TEAM COLLABORATION MODEL
VALIDATION AND KNOWLEDGE TOOL APPLICATION**

**Sue Hutchins and Alex Bordetsky
Naval Postgraduate School
Monterey, CA**

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE JAN 2006		2. REPORT TYPE		3. DATES COVERED 00-00-2006 to 00-00-2006	
4. TITLE AND SUBTITLE NPS Testbed for Team Collaboration Model Validation and Knowledge Tool Application				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Naval Postgraduate School, Information Sciences Department, Monterey, CA, 93943				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES Collaboration and Knowledge Management (CKM) Workshop, 24-26 Jan 2006, Cambridge, MA					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 9	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			



NPS TESTBED FOR TEAM COLLABORATION MODEL VALIDATION AND KNOWLEDGE TOOL APPLICATION

- **Dual Goals:**

- 1) **Test applicability of using a wireless network for data sharing to facilitate reach back to experts for radiation source analysis and biometric data analysis.**
- 2) **Understand and improve the effectiveness of team decision-making in complex, data-rich situations by validating the model of team collaboration.**

Model of Team Collaboration

- **Emphasizes cognitive aspects of the collaboration process and includes the major cognitive processes that underlie this type of communication:**
 - **(1) individual knowledge building**
 - **(2) knowledge interoperability**
 - **(3) team shared understanding and**
 - **(4) team consensus (Warner, Letsky, & Cowen, 2004).**
- **Validate that these processes exist and how they contribute to team performance through verbal protocol analysis coding of team communications.**
- **Learn how the EWALL can support collaborative problem solving within the scenarios/ tasks employed in the GIGA CODE Lab.**



Scenario: Maritime Interdiction Operation (MIO)

- Board ship to search for contraband cargo and possible terrorist suspects
 - Intel indicates vessel may carry radioactive material – positive ID of source in short time is imperative
 - Crew members may be terrorist suspects posing as crewmen
 - Boarding team boards suspect vessel and establishes collaborative network and begins their respective inspections and data collection processes
- Boarding Party Team Members:
 - Boarding Officer – Coast Guard, laptop with Groove collaboration tool
 - Lawrence Livermore National Labs – portable radiation detection devices
 - Reach back to LLNL to analyze data to determine presence of radiation
 - Defense Threat Reduction Agency (DTRA) – collect video imagery
 - Reach back to check against databases at remote facility
 - Biometrics Fusion Center – Biometrics measurements
 - Fingerprints checked against databases at remote facility
 - Special Operations Command (SOCOM) – simulated by LCDR at NPS
 - Leadership provides guidance on handling of hazardous material
 - Network Operations Center – NPS
 - Monitoring/ recording wireless network performance



TEAM COLLABORATION MODEL VALIDATION AND KNOWLEDGE TOOL APPLICATION

Problem Area Characteristics

- Collaborative Situation Parameters
 - Time pressure
 - Information/ knowledge uncertainty
 - Dynamic information
 - Large amount of knowledge
- Team Type
 - Asynchronous
 - Distributed
 - Culturally diverse
 - Heterogeneous knowledge
 - Unique roles
 - Command structure
 - Rotating team members
- Operational Tasks
 - Team Decision Making, Course of Action (COA) Selection
 - Develop Shared Understanding
 - Team Data Processing



Tasks

- **Finalize scenario to include collaborative problem solving (Oct 05)**
- **Finalize data collection plan (Oct 05)**
- **Collect and analyze data without EWALL capability (Nov 05 – Feb 06)**
- **Report findings wrt macro-cognitive processes and team performance (Mar 06)**
- **Collect and analyze data with EWALL capability (Feb 06)**
- **Report findings wrt macro-cognitive processes and team performance (May 06)**
- **Analyze comparative data (Jul 06)**
- **Final report on relevance of macro cognitive processes and impact of EWALL on team performance (Sep 06)**



Technical Approach

- **Code team communications using cognitive process definitions developed by Norm Warner.**
- **Focus on knowledge building and team consensus for:**
 - **Finding and verifying radioactive material: Is it raw material for a nuclear weapon?**
 - **Finding and verifying centrifuge parts: Can the equipment process radioactive material into a nuclear weapon?**



Collaborative Workspace

- **Bring expert services into the boarding party team's tool set**
 - Support ability to quickly assess situation and quickly interpret the data
- **Facilitated voice and text communications between all members of virtual boarding party and physical boarding party**
 - Remote sites able to receive/ open posted files <2 min to begin analysis
 - Expert services provided at LLNL quickly determined need for additional data capture of longer length and different angles of approach
 - Request transmitted by text message and taken for action
 - Radiation source spectrum captures were made of suspect containers that were detected to have a radiation signature presence
 - Analysis led Boarding Officer to recommend that the vessel be quarantined for further inspection
- **Biometric team took digital prints of crew to compare to known criminal prints and latent prints from terrorist and crime scenes.**
- **Great potential for producing communications that reflect complex human decisionmaking problem**



MIO Scenario Coding Example

Team Shared Understanding Development

MIO Team Communications

DTRA Cesium 137 can be used to make an RDD. If there are no explosives, then it is not configured as a weapon yet. Recommend material be confiscated.

BO Rgr will confiscate.

BO Mark material for confiscation.

BO Make sure you handle carefully. Cs-137 is an external gamma hazard.

BO Rgr. Will take precautions.

SOCOM Does CG ship have proper storage area for mat'l confiscated?

SOCOM Search team will report size of material and its current containment condition; then make recommendations.

Cognitive Process Coding

MCsa: develop, rationalize and visualize solution alternatives = using data to justify a solution

MCitk: individual task knowledge dev't. = individual TM clarifying data

MCkio: knowledge interoperability = TMs exchanging knowledge among each other.

MCitk: individual task knowledge dev't = individual TM clarifying data, asking for clarification.

MetCcu: team integration of individual knowledge for common understanding = one or more TMs combine individual pieces of knowledge to achieve common understanding



MIO Scenario Coding Example

Knowledge Interoperability Development

MIO Team Communications

BO Negative for explosives Station 2
LLNL finally rec'd RAD data from station 2
SOCOM ...Will need to resolve RAD
containment hazard if it exists.

DTRA ...If you have plutonium, you need to
confiscate. It's an alpha hazard, but still
must be handled carefully.

BO Rgr

DTRA BTW, if plutonium is in solid metal
form, your team can handle safely with
rubber gloves and a dental face mask,
depending on how much is there.

BO Talking to search team to see if this is
within their capabilities or if we will
need outside assets.

LLNL Hazard is probably minimal, can
isolate and confiscate.

Cognitive Process Coding

KIO: knowledge interoperability
development = TMs exchanging
knowledge among each other.

KIO: “

MetCCU: team integration of know-
ledge for common understand-
ing = all TMs combine individual
pieces of knowledge to achieve
a common understanding.

MacKIO: knowledge interoperability
development = TMs exchanging
knowledge among each other.